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THE CONTROL OF MYOPIA*

Theodore Cohen, Opt.D.
New York, N. Y.

There are so many reasons for the practice of Control of Myopia, that I shall not impose upon you by citing them at any length.

I shall content myself merely with mentioning the results of several well known surveys. The first is Public Health Bulletin No. 182, which states that a survey of 15,000 school children of Washington, D. C., appears to indicate that myopia increases 600% between the 1st and 5th grades. Another survey states that it increases 600% between the 9th and the 15th year.

The Dartmouth Survey discloses that there is apparently no correlation as between good sight and good scholarship. The prevalence of ametropic errors among the top scholars (mostly myopia) was so marked as to lead the writers of the report to speculate as to whether or not the possession of a refractive error was not a prerequisite for scholarship.

The important disclosure of these surveys is first that myopia is on the increase (statistically estimated at about 100% per year) and second that it is found chiefly among students and scholars.

I refer to these surveys chiefly because they will assist me in tying up these known facts with the concept of myopia to which I subscribe, as opposed to the classical concept of myopia enunciated by Helmholtz.

At the outset, I should like to make it clear, that I do not pretend to know enough about nearsightedness to give you any absolute definition. As a working hypothesis though, I subscribe to the concept of the Graduate Clinic Foundation, that myopia is a concession or an adapta-

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tion made by the organism for the purpose of preserving the existent patterns of accommodation and convergence.

This definition does not deny the existence of myopia, as an anomaly in which there is actual lengthening of the anterio-posterior axis of the eyeball.

I do, however, most emphatically deny that any or every case manifesting lowered visual acuity correctable by concave lenses, or showing against motion in retinoscopy, is necessarily myopia in the structural or absolute sense. On the contrary, I choose to regard it as a functional anomaly (almost regardless of degree) until I can prove to my own satisfaction that it is myopia per se. In the course of these comments I shall refer then to the classical definition as absolute myopia, to my concept as functional myopia.

While many optometrists agree that there may be such an anomaly as functional myopia—they act as though all myopia was absolute—they prescribe that correction which restores vision to 20/20. They pay lip service to the idea but act in no wise differently than they would if the case was established as one of absolute myopia.

The problem, of the control of myopia, stated as simply as possible, is what to do with a case that may be functional myopia, how handle it so as to afford not merely improved vision through lenses but actual correction of the condition by a restoration either partial or complete, of lost vision. It would seem, then, that if what we did resulted in such a restoration of acuity (unaided by concave lenses), we would be justified in saying that despite the evidence of our retinoscope, despite the fact that originally vision could be improved with minus lenses, this case at least was not one of absolute myopia. Obviously it must have been a functional anomaly. I propose to cite just such a case as this, detailing what was done to bring about a complete restoration of vision.

A single isolated instance of this sort would prove nothing but when it occurs again and again with monotonous regularity not only in my own practice but with many other practitioners, it becomes a phenomenon that should make every optometrist stop and review, and reorientate his thinking with regard to myopia. A respectable amount of evidence is accumulating to bear out the validity of the concept of myopia given you at the start of this paper.

Not only is this true among optometrists and such psychologists as Samuel Renshaw, Wolfgang Kohler and others but among ophthalmolo-

gists as well. Dr. De H. Prangen of the Mayo Clinic at Rochester, Minnesota, has recently made a statement with regard to refractive errors and myopia, in which he said that the structural theory of myopia is untenable.

Dr. Reynolds Hayden, U. S. Navy Medical Corps, has said much the same thing when he stated that he believed it necessary to have a hyperopic reserve of from ¾ to one full diopter to avoid myopia. This statement was made in commenting upon the fact that 55% of the 1942 class at Annapolis was myopic in 1940.

None of these writers or commentators deny the existence of absolute myopia per se, but they do deny also that all cases manifesting lowered visual acuity and accepting minus lenses with subsequent improvement in vision are necessarily myopes, and feel that certain of these cases are but functional anomalies that respond to different handling than the usual method of prescribing minus lenses. Up to this point, I have sought to define our terms and to provide a background for our concept of myopia. I realize, however, that readers are more interested in what is actually done in a case of functional myopia, and so I shall present for your consideration a case illustrative of the actual handling of these patients.

Mr. L. S., a student in High School, aged 15, presented himself for examination on February 4, 1940. Patient's statement of complaint was that distance vision was poor. Prior to a year ago, his vision was apparently normal since he was able to pass the school visual tests, only during the past year had his sight become progressively worse. In cold weather eyes became bloodshot and watered. No difficulty whatsoever was encountered at near. Since he planned to enter the Naval Academy at Annapolis and knew that he would never pass their visual tests, he was consulting me upon the advice of his optometrist to see what could be done to restore naked visual acuity to normal. His general health was good. V.A. = O.D. — 20/60 —. V.A. = O.S. 20/60 —, —. O.U. slightly better.

He was left handed and left eye was dominant. Freedom of movement of eyes was adequate, versions and rotations adequate. Lids negative, conjunctiva reddened, cornea iris pupillary reflexes negative.

Ophthalmoscopic examination revealed no pathosis. It was noted however, that the nasal portion of each disc was somewhat blurred or obscured as to outline. Tests disclosed that macular stereopsis was 30%.

Static retinoscopy showed apparent myopia neutralized by

O.D. — 1.25
O.S. — 1.25 ⌒ — 0.50 cyl. × 40

Subjective tests indicated that O.D. — 0.75 D.Sph. and O.S. — 0.75 D.Sph. ⌒ — 0.50 D. cyl. AX 40. This correction gave 20/20 O. U. This correction was the least minus that would just give him a bare 20/20 V. A. with both eyes, not with each eye alone.

It was explained to the parent that nothing definite in the way of improvement could be promised—that the case would be taken, for a preliminary period of three weeks. If, during this time, an improvement in naked vision could be effected, we would continue with the case; if not, I reserved the right to discontinue orthoptic measures.

With this understanding orthoptic treatment was instituted on February 12, 1940. The patient was seated at the rotoscope and instructed to follow with one eye (the other occluded) the rotation of the red jewel. The purpose of this exercise and the four others that followed was two-fold. The first was to insure the presence of the basic visual skills, i.e. the pursuit reflex, the saccadic reflex, the monocular macular placement reflex and the binocular macular placement reflex. Second, to break down the present pattern for seeing, which I believed was a defense mechanism—a defense mechanism which enabled him to continue using his eyes at near. Bear in mind that he is a student and has to maintain fixation of focus and convergence for long periods of time within relatively restricted areas. Such tasks seem to set up resistances within the organism, that stamp maintained reading and studying as artificial visual tasks. Such artificial tasks bring about changes in the patterns of accommodation and convergence.

The second exercise for the purpose of testing and possibly restoring the validity of the saccadic reflex required the patient to fix his gaze upon the red jewel, yet by indirect vision still be able to see the green jewel (which had been displaced upward) throughout the whole arc of rotation. The patient could not at first maintain the indirect target in view, losing it frequently during the course of its rotation. Finally, however, he was able to fix on either target and still keep the other in view.

The third exercise, performed with one eye occluded, was accomplished by having the patient follow a moving object and then interposing a 10△ or 15△ prism which displaced the object. The patient was required to name the direction of displacement by calling out that the object apparently moved to the right, to the left or up or down.

The fourth exercise differed from the third in that both eyes were

used, and that the targets employed were of the type used to stimulate first or second degree fusion. For example, a cage on one and a bird on the other. The patient was directed to watch the bird in the cage as the targets rotated. A 10△ prism was then interposed. Now the bird was displaced to the right of the cage or to the left. Upon the sudden removal of the prism the bird appeared to jump back into the cage.

These four exercises were repeated daily for about 10 days to two weeks until it became evident that the patient could handle each exercise smoothly and easily.

In addition to these four exercises, a fifth one was used which we shall call ciliary rocking. With patient seated in the chair and the phoropter in place, a + 1.00 D. sphere was placed in the cell in front of the right eye, and a — 1.00 D. sphere in front of the left. With the left eye occluded the patient was given rather fine reading material and directed to read through this plus lens quantity for a moment or two. Suddenly the right eye is now occluded and the left opened so that he was now called upon to read through a — 1.00 D. sphere. This process was repeated 10 or 12 times and the plus and minus lenses reversed so that now the left eye cell would hold the plus lens, the right the minus and the patient directed to read again. When he could quickly and easily clear the slight blur which ensued when switching from the minus to the plus lens the whole process was repeated with quarter diopter stronger lens. After some ten days or two weeks of this treatment the patient could clear as much as — 3 D. in one eye and + 4 D. in the other and vice versa.

The purpose of this treatment becomes evident if we give the process a moment's thought. With a minus lens in front of the right eye for example, and the other blocked off, no convergence is employed since we have *monocular* vision in use. The minus lens, however, causes a stimulus to accommodation not only in one eye but in both. When that eye is suddenly occluded and the left eye cell opened and the print viewed through the + 1 D. sphere, accommodation is now inhibited to the extent of one diopter. This alternate ciliary stimulation and inhibition which we call "ciliary rocking" builds a facile use of accommodation and insures ready response when called upon to function in conjunction with its associated reflex of convergence.

It is a necessary step when we remember that accommodation is accomplished through smooth muscle tissue, which you will recall is slower to contract and slower to relax than is striated muscle tissue.

Let us review this first phase of our treatment which is called primary rehabilitation. First the patient was drilled in following one or more moving targets for the purpose of ensuring the presence of certain basic visual skills, namely the pursuit reflex, the saccadic reflex and the monocular macular placement reflex. Next by means of alternate plus and minus lens quantities the patient was taught a facile use of the ciliary muscles or of the accommodation alone, without the use of the convergence reflex usually associated with the act of accommodation.

Now we are ready for the second phase of the reconditioning process, that known as specific repatterning or specific reconditioning.

The patient was seated wearing the correction which just enabled him to read 20/20 which at this stage, some weeks after orthoptics had begun, was now

O.D. — 0.25 D.Sph.

O.S. — 0.25 D.Sph. ⌒ — 0.50 D. cyl. × 40

To this correction was added O.U. + 2.75 ⌒ 4△ base-in, so that the patient was really looking through

O.D. + 2.50 D.Sph. ⌒ 4△ base-in

O.S. + 2.50 D.Sph. ⌒ 0.50 D. cyl. × 40 ⌒ 4△ base-in

with which he was required to read very fine print, placed at 16 inches for a moment or two, and then all illumination was switched off, leaving the patient in total darkness. After 15 or 20 seconds the light was again switched on and the patient directed to again read. At first he reported that the print was very blurred but after repeated attempts the print cleared. This technique of alternately flashing on the light instructing the patient to read, then flashing it off, was repeated and repeated forty or fifty times at each treatment session until the patient was able to clear the print immediately upon the light being turned on. In subsequent sessions this amount of lens power was gradually increased by quarter diopter steps until as much as + 3.50 D. was in use. At the same time the prism was increased until as much as 6△ base-in was in place in front of each eye. This procedure was continued daily until subsequent examinations showed that changes along the desired lines were taking place in the syndrome of symptoms.

An examination made after 10 days did show marked changes. For example, the number 7 finding, which is the subjective that just enables the patient to obtain 20/20 acuity, was now found to be + 0.25 D. instead of a minus quantity. The number 17b finding, or negative

fusional reserve, was now found to be 26/22 instead of 20/18 and the 21 finding now + 2.75 D. instead of + 2.50 D.

Specific reconditioning was now resumed and the effort made to reduce the amount of base-in prism power associated with the plus lenses. Slowly the base-in was gradually reduced slightly at each session as the light was flashed on and off until zero was reached. Just as gradually base-out was introduced until clear vision could be maintained with + 3 D.Sph. and 3△ base-out before each eye. Five or six days of this orthoptic work sufficed, and at this point the patient was re-examined. As a result of this examination the patient was advised to discontinue further treatments for a period of at least two months. He was provided with a bifocal correction to wear in the schoolroom and at home while studying. This correction had a plano distance portion and a + 1.50 D. add. With this prescription he continued his studies, which averaged about 4 hours each day of homework in addition to his classroom studies.

He did not return until September when I re-examined him. At this time his naked vision was 20/20 O.D., O.S. and O.U. During December, 1940 he accepted + 0.25 D. cyls., against the rule, which gave him a visual acuity of 20/15. Naked vision was now 20/15, — 1 in O.D., and 20/15 — 3, in O.S. O.U. 20/15. This correction was made up with + 1.50 D. add in bifocal form.

It should be added that as war came on the patient decided to forego Annapolis and try for Naval aviation. As recently as the fall of 1942 he still obtained a visual acuity of 20/15 for each eye and had passed his physical examinations for Naval aviation and was then at Pre-flight School at Chapel Hill, N. C.

Now to return for a moment to the orthoptic treatment. Let us review the specific repatterning or reconditioning techniques. In the final analysis the primary rehabilitation, while given for the purpose of ensuring the presence of certain basic visual skills, was in reality a method of assuring ourselves that before attempting actual repatterning, each eye was capable of working and, what is more, of working together easily and naturally. We have spoken of reconditioning as the second phase of our orthoptic procedure. Just what do we mean by the term reconditioning. As used here the term "conditioning" really means to "create a habit" so that what we are really doing is to recreate certain visual habits that the possessor must have had originally. That this is so is shown by the fact that up to a year prior to consulting me the

patient's vision was normal or even better than normal. You will recall that artificial visual tasks produced changes in the patterns of accommodation and convergence. Our examination procedure showed us that the primary changes resulting from these visual tasks, in this case at least, took place in the pattern of accommodation. Whatever change ensued in the pattern of convergence was an end result due to reflex stimulation from the mechanism of accommodation. If this is true we can inhibit accommodation and convergence although the latter should be, and this is important, inhibited less than the accommodation. In other words we can, for short periods of time, so change the patient's visual environment that we can virtually dictate the amount of accommodation he shall exert as well as the amount of convergence. Then by repetition, repetition and still more repetition, condition the patient to accept such an environment. The important consideration in this process of conditioning is to know the limits to which you can go and to work well within these limits.

To the operator who is properly using the Graduate Clinic procedure those limits are well defined and he is in no danger of violating a reflex and thus doing more harm than good. For example, in the second phase of our orthoptic procedure you will recall that we added O.U. + 2.75 D.Sph. $\supset$ 4Δ base-in to the patient's correction. Why + 2.75 D.Sph., why not + 2 D. or + 3 D. or + 4 D.? The answer is illustrative of the point I have just tried to make with reference to the limits within which the operator must work. The reason + 2.75 D.Sph. was used, was that our No. 21 finding (toleration of accommodative inhibition) was + 2.75 D. Similarly the reason 4Δ base-in before each eye was used, was because it was within the limits of the 17a finding or the toleration of adductive inhibition. When we set up the + 2.75 D.Sph., $\supset$ 4Δ base-in, before each eye of the patient we inhibited two and three quarter diopters of accommodation and one and one third meter angles of convergence, and then we taught the patient that it was possible to converge as much as one meter angle and still not reflexly accommodate at all, in order to perform this visual task of reading.

Let us briefly summarize the information to be gathered from this case.

In the first place, we know from the patient's history that his vision was normal or better up to at least February, 1939.

Secondly, it is fair to assume that at least some degree of his impairment of vision was due to the excessive use of his eyes at near. If

this is true, suppose that we proceed to analyze exactly how close work can so adversely effect his vision. Those of us who subscribe to the concept stated earlier that "myopia is a concession made by the organism to preserve the existent relationship of the patterns of accommodation and convergence," contend that reading is an artificial visual task that brings about resistance in the organism and subsequent changes in the patterns of accommodation. As a consequence of these changes, the mechanism of convergence is stimulated, and by the same token because convergence is so closely associated with accommodation, it stimulates accommodation still further and we have a vicious cycle. The so-called "spasm of accommodation" will probably convey, because it is familiar, some idea of the situation that exists at the near point now. This dominant pattern is projected off at the distance and we have all the symptoms of a case of myopia. Distance vision is poor, the retinoscopic findings will show minus and vision can be readily improved with minus lenses. Now to prescribe minus lenses in a case like this, will not help matters, but will unquestionably increase the patient's difficulty at near and in a short time impair his vision at the distance still more. For minus lens power in this case is an added impetus to the accommodation and so reflexly to the convergence and we have started the vicious cycle all over again, instead of halting it.

Thirdly—that if minus is contra-indicated some other agency or modality will have to be used to break this vicious cycle.

Fourth—that if our refractive procedure is primarily concerned with the problem of obtaining light on how the patient reacts to certain hurdles which we erect, rather than with distant visual acuity and dioptral values, we have a series of clues that tell us what is wrong. Our procedure then also defines the limits of the patient's pattern for seeing.

Lastly—that properly used, the information obtained from the visual analysis enables us to break up the vicious cycle present and substitute a pattern for seeing that is within the patient's ability to handle. This was done by means of the visual rehabilitation or orthoptic procedure just described. The writer believes that this procedure offers a means of properly caring for those cases that might, for want of a better term, be called functional myopes.

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METHODOLOGY IN COLOR TEST PREPARATION*

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It has seemed valuable to summarize the general available information on methodology that is applicable to the problem of testing color vision so that previous and current tests may be evaluated in this respect on an adequate basis.

First, we need to inquire into the nature of tests in general. A test must not be confused with an experiment, which is distinguished by a very precise and limiting point of view. An experiment is basically non-utilitarian and therefore not constrained to get a certain type of results. The assumptions which it makes are self definitive and need take into account only the existing body of knowledge. Basically it consists of observations under conditions controlled by isolation, repetition and variation, so that preferably a laboratory is indicated, where meticulous attention may be given to details.

A test, on the contrary, is designed to perform a specific utilitarian job and the final criteria for judging it will be how well it does that job. We are inclined to believe, of course, that tests will work better if they are based on factual data, and if they follow good experimental methodology. Thus we are often disappointed when a casual judgment or a clever trick appears to serve the practical purpose as well as a more extensive group of test judgments. We can point to examples of this among tests of so-called "color-blindness." The concealed figures of the various pseudo-isochromatic charts are just such a clever "trick." I have used the expression "clever trick" advisedly, but there is no intention to derogate the brilliance of their invention nor the carefulness of the work that was necessary to make them effective. My point is that they do not measure, in any sense, a subject's color vision. They simply "catch" certain individuals who are unable to read them, and magnify that subject's perceptual deviation by appearing obvious to the majority of persons. They tell very little about the visual perception of those who fail, but they draw a sharp line between two groups of individuals—and that is exactly what they are meant to do. So long as we are content to accept the dich-

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otomy, there is no need to seek further. However, the implied factuality of this distinction has frequently been questioned, and now, more important, its value is doubted. Even so, new tests will be examined by the same criterion. Perhaps what is wanted still is a dichotomy, but one with different practical implications, that is, one that draws its line of distinction at a different place and thus changes the relative sizes of the two groups. It may be more useful, however, to have a test that will yield a significant distribution of the population so that various dichotomies can be derived from it. In that case, appeal must be made to experimental methodology, for we have no evidence that repetition of the pseudo-isochromatic "trick" will give us a significant distribution. Obviously, then, test development cannot afford to "go it alone" in total disregard of experimental procedures. Indeed, it is safe to say that the nearer a test procedure approaches experimental conditions the more dependable will be the test results and the more satisfactory those results for practical purposes.

Nevertheless, practical considerations are primary in the sort of test which interests us. It is not necessary that we list exhaustively all such considerations, but there are certain ones that limit our methodology from the start. To begin with, practice usually demands that the test setting bear an obvious relation to the practical problem to which the test results are to be applied. This factor militates against laboratory techniques and apparatus that would otherwise make excellent tests of color vision. Precision instruments ordinarily require trained personnel to operate them satisfactorily, but for some reason it is supposed that anyone can and should be able to test for "color-blindness." Even the services are demanding a test that will be infallible in the hands of a "non-com" or a "C.P.O." In the case of the pseudo-isochromatic charts, acceptance is not general. Casually, to normal persons, it seems obvious that anyone who cannot read the concealed figures must have very peculiar vision, yet the individual who fails is usually unwilling to accept the evidence of his failure since he can discriminate the separate colors that make up the chart and often name them correctly. On the other hand, a matching procedure seems more reasonable and acceptable to both normals and deviates alike, because it corresponds more closely with the practical situations in which color vision is important. We have found this particularly true in the study of color aptitude at the normal and high ability levels.

A second factor of great practical importance for many applications of a color vision test is its time of administration. In situations in which

the color capacities of a large number of individuals must be determined the time factor may be crucial. This means, inevitably, a sacrifice in precision so that almost every such test must be in some measure a compromise. Further, the form in which the test results are rendered may severely modify their utility. This is one point on which it would pay to educate the user of the test, difficult as that may be. The use of dichotomous or classificatory labels is as easy as it is unsatisfactory. "Color-blind" is certainly an erroneous label, and "deuteranope," "protanope," "tritanope," as they are ordinarily used, though more erudite are no less objectionable. Percentile ratings are much in favor, but they too, should be used with caution and should be given more careful definition in particular cases. What can it mean, for example, to say that a man has 75 per cent color vision, on the basis of charts read in one of the pseudo-isochromatic tests? There is the danger, also, of ascribing significance to the individual steps of any 100 unit scale even though the measuring device can be that finely read, when the object measured is much more grossly defined. Why measure an elephant's foot with a micrometer caliper?

Keeping these and similar practical considerations in mind, we may nevertheless emphasize our thesis that "adequate methodology is essential to competent color vision tests" and proceed to consider the controls that such adequate methodology implies. They fall, obviously, into the three groups, psychological, physiological and physical, but their interrelations and relative importance have not usually been made clear. I have stated them in the foregoing order to exhibit their connection to the problem we have in hand. Color vision is essentially and primarily a psychological problem. Any one who undertakes the study of any phase of it becomes to that extent a psychologist and, naturally, the more adequately he encompasses the current body of psychological fact and methodology, the better may we expect his contribution to be. I am not for a moment marking out preserves like a labor organizer, because many major contributions have been made to psychology by non-professional psychologists, but there is a direct relation between the extent and permanence of those contributions and the degree to which the contributors give psychological considerations their proper place.

Psychology recognizes the dependence of its data upon physiological organisms and upon physical conditions which impinge upon and affect the organisms. Therefore we must have in hand the facts of luminous emission and the facts of ocular excitation before we can undertake to map the procedure of our problem in vision. The order of consideration

is not an order of evaluation. Every step is equally essential. This point must be emphasized, because too often a test fails from inadequacy in the psychological step. Physics does not see—its instruments give us only vibratory-corpuscular emission data. Nor does physiology have sight—only retinal-cortical excitations. Psychology, by way of its subject-instrument, has vision.

For the physical controls in a color vision test we must turn, then, to the physics of light, but we must bear in mind that we are not conducting an experiment in light. It is not our purpose, here to do more than indicate the general nature of the physical controls, but this brevity must not be taken as minimizing in any degree the basic importance of such controls. For test purposes, we may divide our available materials into three classes, namely, relatively homogeneous light from a diffraction or prismatic spectrum, filtered light, and light from selectively reflecting surfaces. Each type of material has both advantages and disadvantages and our choice will depend finally upon a summation of these factors in which psychological controls and practical considerations play dominant roles. Probably the use of near homogeneous light gives us a degree of control and reproducibility that cannot be exceeded, if it can be equalled, by any other means. When we are engaged in careful experimental investigation of color vision, we may not be satisfied with less, but for test purposes, this material has distinct disadvantages. The essential instrumentation places laboratory limitations upon us, and to many who need to use color tests, laboratories and instruments are anathema. Practically, also, it is much more satisfactory and fruitful to be able to take your test to your population, than to have to bring subjects to your laboratory. These, of course, are not insuperable difficulties. From the psychological point of view, the limited size of the test field typical of a spectral instrument restricts the scope and validity of the test results. Even more objectionable is the dark surrounding field that is characteristic of an eyepiece instrument. Finally, the perceptual character of the aperture colors is disturbingly different from the normal mode of appearance of colors to the majority of persons, so that judgments on one material cannot be equated to those on the other without considerable practice, a requirement ruled out by test conditions. It is largely because of these factors that the trend of test developments has been away from laboratory instruments.

The use of color filters, while not producing homogeneous light, gives us its equivalent, thanks to the psychological laws of color mixture and to the ICI data. Thus, without sacrificing accuracy we can eliminate

some of the disadvantages of spectral instruments. There is no reason why the objections to size of field, to dark surrounding field, and in some degree to the perceptual appearance of the judgment colors, cannot be met. There still remains the fact that the filters must be incorporated in a more or less elaborate instrument. I know that to most readers this criticism may seem absurd but the objections I have met in many quarters, have often been violent, and the acceptance of more "objective" materials by contrast has been enthusiastic.

It will be apparent from the discussion in another paper of this symposium of current and past "color-blindness" tests that there has been a distinct preference for reflecting materials—yarns, beads, papers, etc. We need not inquire into the manifold reasons for this preference, but they have accidentally or intentionally, been in line with the greater psychological advantages. Now that advances in colorimetry have improved the accuracy and facility of measuring colored surfaces, their major disadvantages have been removed. They remain dependent for precision, however, on the illuminant which is used, and the importance of this factor is not fully credited by the layman. The choice and production of reflecting materials for color test work presents the technological problems of permanence of the pigments, resistance to surface abrasion, reproducibility, and size of gradations. Recent experience has shown that all of these can be dealt with satisfactorily. Perhaps the factor of greatest advantage is the close perceptual similarity between such materials and those which enter into the practical situations for which tests are designed. This is important for a test, even though it gives no information concerning the nature of the visual defects in question and may often obscure such facts, but as I have said above, testing for visual divergences in a large population, which is the function of a test, cannot be substituted for careful laboratory study of vision. There is the further danger, in the use of reflecting materials, that they will be chosen casually on the basis of their appearance and without scrupulous regard for their physical reflectance characteristics. This point cannot be over emphasized! It is crucial to all further work an dexplains why the older yarn tests and some of the current "practical" tests do not give reliable results. On the other hand ,the fact that lights of two different spectral distributions can be made to match for the normal subject may be one of the "tricks" that can be evolved into a color deficiency test. Already, it is being used as a test for a related problem.

Let us turn now to the physiological conditions that must be con-

sidered. Again we shall simply point out the factors that must be given detailed study with respect to every individual test. Physiological optics must be a primary concern in our control of the conditions of excitation. Often the physical and psychological precautions will include the physiological, as for example, area of the test object raises the question of foveal *vs.* peripheral excitation, and pupillary control, the question of excitation intensity. There remain, however, such problems as innate *vs.* acquired color disturbances, the dependence of color vision upon systemic conditions, metabolic, toxic, etc., the interrelation of the photopic, and scotopic functions, the question of whether color deficiency can be improved, by vitamin feeding for example or by retinal treatment. The nature of the retinal correlates of color vision, normal and deficient, is always intriguing, but physiological hypotheses of visual functions may be more hindrance than help in working out an adequate test methodology. There is no question that in the past they have been a great motivating factor. Investigations to prove or to disprove particular theories have produced a wealth of factual observations, but in many cases, "theories" themselves have obscured the proper direction of attack for an adequate test procedure. The greatest fault in this respect is with the "Trichromatic Theory of Vision." I am not referring, naturally, to the laws of color mixture nor to the data on three color mixture equivalents to spectral colors. I am objecting, rather, to certain physiological and psychological inferences that have been made from such data and have been elevated to the rank of pseudo-facts. It is my own interpretation that as we learn more and more about the retina, the less evidence we have that its function is anything like as simple as a matter of three photochemicals. To this objection may be added the absurdity of trichromatic theory for psychology. As this specifically affects our problem of a color vision test, that theory has saddled us with the misleading terms "deuteranope," "protanope," "tritanope." If they are redefined to refer simply to the three color mixture equivalents of spectrum colors for color deficient subjects, they may serve a useful function of comparison, but they must be divested of the implications of physiological explanation and psychological fact carried in the pseudo-descriptive translations "green blind," "red blind," "blue blind." Much more experimental work is needed from a psychological point of view before we can use legitimately such terms as these, and we shall be led astray if we take them as descriptive and allow them to determine our test procedure.

As I have indicated above, colors being primarily psychological

data, a color vision test involves of necessity psychological procedure and after having worked out the physical and technical controls it would be folly to be any less precise psychologically. Yet the major criticism of many color vision tests is their casualness in this respect, apparently for no other reason than disregard of the available facts. For purposes of psychology, the human organism may be looked upon as an automatic recording instrument, like a recording voltmeter, or thermometer, or photo-electric spectrophotometer. Flash light upon its sensitive elements and you get reports of color. In the experimental laboratory, the psychologist must spend time and effort calibrating or training his instrument to a high level of sensitivity, accuracy, and stability. As a tester he does not train or calibrate, but takes the crude instrument as he finds it and attempts to obtain as precise a measure of its capacities and limitations as the situation permits. But the instrument is the same that he has struggled with in the laboratory and he knows, therefore, many of its limitations and vagaries, and may profit accordingly.

First of all, let us dispose of the fallacy that a visual test measures visual "sensations." One doesn't find "sensations" running around in the psychological laboratory or anywhere else. They exist only in textbooks and in the minds of psychologists as concepts which serve as reference points. Human instruments or observers or subjects perceive various phenomena and can report upon them by indicating the appropriate, carefully defined categories, e.g., red, yellow, blue, etc. In a casual problem the subject points out the color qualities present in a given perception much as a pointer moves along a scale. Obviously, the simpler his task the more steadily he will perform it. Thus, if he is permitted to say "this is like that," he will do better than if he has to say "this is red" and "that is green." If the report is still further complicated perceptually by requiring a number or a design to be read, additional factors are involved.

Since any test of vision presents the subject with a perceptual problem of some sort, such as matching, discrimination, recognition of form, etc., we must take account of the factors that enter into such perceptual patterns. Some factors can be dealt with in the planning of the test materials, some must be got at by way of the test situation, but a few are inherent in the organisms that are being tested and while they cannot be eliminated or controlled their presence and nature must be recognized and taken into account.

Size of the test object is important in any test, partly because it controls the physiological factor, the area of the retina stimulated, but

as much or more because of its effect on the judgmental pattern. For this reason we cannot refer judgments on one area to equivalents at a larger or a smaller area. For specific conditions, comparative data have been obtained that bear this out, but for any other conditions they must be obtained empirically. In general, large areas improve discrimination, subject as one might expect to the Weber-Fechner law of "diminishing returns." Thus the National Bureau of Standards uses 4-inch placques in making certain surface color comparisons. Mr. Foss made the casual observation in the course of preparing the ISCC test materials that the large colored placques about a foot square showed much more obvious differences in the series than they did when they were cut up into inch-and-a-quarter by inch-and-a-half chips. As applied to our particular problem, one of my color-blind subjects who is a highly trained observer insists that a large area of red is obviously different from and, he believes, redder than, a small area of the same reflectance characteristics. On the other hand, using the ISCC saturation series of reds with normal subjects we have found that when the chips are masked down to two partly overlapping (1/5 circum.) disks of one cm diameter the same discrimination curves were obtained as with the full size ($1\frac{1}{4}'' \times 1\frac{1}{2}''$) chips. These results are not entirely unequivocal because the steps of difference in the series are all supra-liminal. Reduction of the area left them still supra-liminal.

Size unquestionably works against the ready acceptance of color test instruments using eye-pieces and having, consequently, small judgment areas. A test which utilizes areas more in accord with those ordinarily perceived in practical situations has obvious advantages. In any case, we must not forget that a subject's visual field has a fixed size and that Hering's law of reciprocal spatial relations is always effective, *viz.*, every area of light or color in the visual field affects and is affected by every other area. It is essential, therefore, that a large area surrounding the judgment area, and in some measure the whole visual field, should be controlled as precisely as the colors under observation. The dark field of an eyepiece provides this control, particularly if it is used in a dark room. Such conditions, however, set up dark adaptation, altering the photopicscotopic relationship in the retina, and changing the perceptual characteristics of the colors, which is highly undesirable. A preferable background is neutral or middle gray which need not cover the entire visual field, but should occupy a large region about the judgment field. Such a background must always be used if reliable results are to be obtained, and where

possible should be incorporated into the test equipment.

Where test areas are juxtaposed, it is essential that the length of the lineal contact be kept constant, and that the line of demarcation be always the same. Again, these factors are fixed in most eyepiece instruments, but may be highly variable with reflecting materials. Their importance was brought home to us early in our work with the ISCC test. For reasons of production our chips are rectangular, and we found it necessary to specify the dimension which should be juxtaposed. It also proved best to use a minimum line of demarkation, even at the expense of reducing the ability to discriminate and thus reducing the sensitivity of the test.

The spatial arrangement, Right-Left or Up-Down, of a pair of colored areas affects the comparison judgments a subject makes of their appearance. In a long series of judgments on the same pairs, trained observers will show a considerable difference between the R-L position and the L-R, and between the U-D and D-U. With untrained subjects, it is much greater. The space error is individual and unpredictable, so that a fixed arrangement of two areas will favor some subjects and penalize others, in every case to a different degree. For experimental purposes the space error must always be compensated by duplicating all judgments using both positions. In a test, such multiplication of data is not always possible, but its omission often invalidates any extensive statistical treatment. For certain purposes, it has been useful to make the judgment areas into annular rings, but this does not eliminate the space factor, and actually magnifies the difficulty when the area is fairly large, e.g., 10 to 20 cm viewed from one meter. Thus, when a disk of 10 cm is placed upon one of 20 cm one frequently gets four different judgments according to the radius upon which the observation is made. In our experience, the vertical dimension appears to give less space error than the horizontal, therefore, in the Aptitude Test we standardized upon that and obtained only up-down judgments. In another test where it was more convenient to use the horizontal arrangement we duplicated judgments in both positions, and we did not make the mistake of expecting the two sets of judgments to agree.

Fortunately, the time error does not enter, as such, into a visual test, but when a series of judgments from a number of paired stimuli is being taken, the final score may be influenced by the order in which the judgments are given. This may be due in some measure to the temporal effects in vision, *viz.*, adaptation and its after effects. Discrimination is

not the same when you work through the spectrum from blue to red as it is when judgments are begun at the red end. A small difference may be judged "equal" following a larger difference and "different" following a smaller difference. The order factor cannot be eliminated but it can be stabilized, in a test, first by following a haphazard arrangement of stimuli and, second, by using the same order for all subjects. The relative values of the scores are thus freed from intra-serial effects.

In the discussions of the order of succession and of the surrounding field, we have indicated two needs for control of the whole visual field. In addition, a check must be kept on the absolute intensity of the general visual stimulation. Since we are concerned with color vision, there will be a lower limit above which we can depend upon the validity of our data. For practical purposes this lies considerably above the scotopic or twilight vision level. Vision, however, adjusts itself so readily that differences from 10 ft.-c to 100 ft.-c have given no significant effect in tests of discrimination. Some subjects have been found to protest at illuminations above 50 ft.-c especially of artificial illumination. Most, however, have found as high as 200 ft.-c of north daylight agreeable for close judgments.

How many judgments to require in a particular test is one of the most difficult questions we have to settle. In this we stand between the practical demand for brevity and the statistical need for an adequate sampling. The question of the number of judgments upon which a limen may be based has been discussed in the literature by Fernberger and Boring. For our purposes, the argument summarizes to "It depends," and we are left to solve the problem for ourselves. The answer in any particular case will depend on the type of judgment required in the test. If a test is based upon recognition of a more or less complicated pattern, such as the pseudo-isochromatic charts, multiplication of judgments adds little to the certainty of the test. However, sometimes repetition by means of charts showing different letters or numbers must be made to circumvent learning of the right answers. If one simplifies the judgment, more repetitions must be given. When the subject is asked simply to report "same" or "different," we have required of him the simplest and therefore the most stable judgment possible, but we shall need a larger amount of data from every individual. We shall probably find it necessary, also, to increase the variety of discriminations. We actually tried this procedure and found it unsatisfactory. For a test of color vision deficiency we needed to get not only discrimination, *per se*, but also a qualitative

indication of the direction of the discriminated difference. It is not as stable a judgment, but we were after a test score not a discrimination limen.

Also, for test purposes, we found it advantageous to complicate the judgment even further by requiring it to be made in the form of a matching adjustment. Ordinarily, careful experimental procedure excludes the method of adjustment because it introduces uncontrollable factors that are extraneous to the judgment desired, but for test purposes this very complication aided in bringing out the individual differences in which we were interested. I have already pointed out that we were not testing eyes, but *eyes in use,* i.e., visual perceptual aptitudes, and the success of such a test depends more upon the choice of the perceptual pattern than upon any other single factor. It is precisely there that the "trick" succeeds or fails. No general rules can be laid down, but I can illustrate the point by reference to some of our experience with the various forms of the color aptitude test. We asked for discrimination judgments, but it made all the difference between test and no test how these judgments were given. With a little training all of our normal observers could say accurately which of a pair was "redder" or could place the whole group accurately in an ascending series, but it was more difficult to match a duplicate series to the first when it was arranged haphazardly. However, too many subjects succeeded perfectly to make it a useful test procedure. Success came, finally, when one match at a time was required among a haphazard group. With subjects whose color vision deviates, the situation proves to be quite different. A group of only twenty chips, chosen of course to offer the confusions indicated by experimental results, presents a perceptual pattern of a complexity that varies with the degree of deviation. This gave us the type of distribution we sought. From it we can make the deuteranope-protanope dichotomy if we wish, because our materials were prepared with this in view, but the results also show that the confusions of one type are far from being completely distinct from the other. "Deuteranopes" make many "protonope" errors and "protanopes" many "deuteranope" errors. For once a test has given us a fairly precise indication of this particular aspect of visual anomaly. When additional materials are available the tests results will take on further psychological significance. I have cited our experience with this test to show the intricacies involved in selecting the type of judgment to utilize in a color vision test.

Closely connected with the type of judgment is the form of the

instruction by which the task is set up for the subjects. Even the simple direction to "find the matching chip" can be taken in ways so different as to give widely divergent results. Test instructions must therefore, be explicit. They cannot be left to the discretion of individual testers, but should be presented in printed form with standardized directions. Sometimes a particular word may be useful in bringing out color deficiency by the very fact that it is equivocal only to such subjects. We found, for example, that the instructions to "judge the redder" of two chips, while it did not appear sufficiently precise to some normal subjects, because of the low saturation of the colors, was entirely equivocal to color deficient subjects who, on the other hand, had no difficulty in judging simple likeness to a standard red.

Learning is a characteristic of all human organisms and, consequently, is present in some degree in any test performance. The second ten judgments are likely to be better than the first ten. The effect can be minimized in various ways specific to a particular test. In many cases results may be stabilized by means of a practice series, but usually it is not valid to compare "test" with "retest." For most purposes, we require of a test that there be a maximum level of attainment beyond which a subject cannot go no matter how much he practices. In the ISCC aptitude test this is the case, and we found that speed of adjusting to the test requirements at the beginning, that is, practice, was a significant part of the test problem.

Finally, the general capacity level or intelligence of the individual subjects cuts across all psychological test results. It does not, however, stand as a criticism of them. Tests of the sort we are discussing are tests of color vision in use, and eyes of equal physiological function in organisms of different intellectual capacity will yield different practical results.

Usually, a discussion of tests moves from this point into a consideration of the statistical treatment of data. We have already discussed the number of judgments in a test as it affects the practical problem of the time, and the form of the results required by the practical problem. We shall not pursue the important question of statistical procedures further, since there are ample treatises on the subject from which each experimenter can choose. Suffice it to say that such treatment of results is a necessary evil of all test construction.

SUMMARY

I want to repeat that in the preparation of tests of color vision the methodology employed is all important. Physics and physiology fur-

nish the material conditions. This paper has been concerned with them only to point out their basic importance. It has seemed sufficient also simply to remind us that the utility of a test is a practical matter that will override many considerations of precision and accuracy. It has been our principal concern to emphasize that the essence of a test consist in the judgments by the subjects and that we shall have no adequate test unless the psychological conditions are properly controlled by a suitable methodology. A number of the judgmental situations met in a test of color vision have been described in some detail. While size, position, order, adaptation level, number and type of judgments, form of instructions, practice, capacity level do not exhaust all the problems of psychological methodology, they form a minimum of controls for any test of color vision.

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A QUESTION OF RANK FOR OPTOMETRISTS IN THE U. S. ARMY

Clapesattle[1] points out that during World War I, American medical officers were very much exercised over the question of rank accorded them by the United States Army. It seems that up to and including the early part of our participation in that war, regular Army medical officers could not attain a rank of higher than colonel, while Army reserve officers in the medical corps could not attain a rank higher than major. In the French and British forces medical men could acquire the rank of

[1]Helen Clapesattle. The Doctors Mayo. University of Minnesota Press. Pages 564-565. 1941.

general and a number of the leading physicians of both countries were granted this high honor. According to Clapesattle it was not until July 9, 1918 that Congress approved a bill according medical officers the right to all ranks from lieutenant to major general.

This medical bill was passed at the very height of our participation in World War I and this was accomplished, according to Clapesattle, only because the medical profession fought a good fight to get Congress to vote physicians their proper military rank.

This fact is not without its significance to optometrists. If physicians could properly engage in a tussle with both Army leaders and Congress in the middle of World War I to attain their own just ends, there is no reason why optometrists should refrain from doing the same thing in World War II.

During the first World War physicians felt discriminated against by the Army proper who seemed to consider all health work just a necessary evil and who begrudged physicians recognition equal to that of other technically trained army personnel. During World War II optometrists find themselves discriminated against by both the Army proper and the Army Medical Corps who jointly seem to think all refractive work a necessary evil and who begrudge optometrists who are doing a large part of the refractions the recognition equal to that of other technically trained army personnel. The parallel between these situations is perfect and the answer is obvious. If optometrists are to receive the recognition due them they must petition Congress to establish an Optometric Army Corps. Medical men have fought this fight with success and so can we. Failing to do so will just continue a bad condition already well reviewed.[2, 3]

Of course it goes without saying that we should not start this fight unless we intend to win it. It will be an all-out effort on the part of optometry—if the effort is made. But the facts are so clear and the need so great that nothing should be permitted to delay the action. Clapesattle also points out that while physicians were busy in 1918, in improving their own status in the medical branch of the Army, they were also engaged in preventing chiropractors, osteopaths and chiropodists from receiving admission in the Army medical corps. This same opposition

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[2]Carel C. Koch. Action now required on Army Discrimination Against Optometrists. Editorial. Amer. Jour. Optom. & Arch. Amer. Acad. Optom. Vol. 20. No. 7. pp. 251-255. 1943.

[3]Carel C. Koch. An Optometric Army Corps. Editorial. Amer. Jour. Optom. & Arch. Amer. Acad. Optom. Vol. 20. No. 10. pp. 372-382. 1943.

may arise in certain quarters of the medical group if optometry makes the attempt suggested. But there is a vast difference between optometry and the groups just mentioned. Optometrists are now serving in the medical corps—doing ocular refractions. Optometry is not on the outside asking to come in. Just the contrary. They are in—working long hours each day refracting hundreds and hundreds of military men. As technically trained professional people, they are now doing the job. All that is asked is that they receive the recognition which properly goes with the work performed.

As the writer has said before, this is a fight that can be won. It will require a high degree of leadership and a united optometric front. The latter is assured as we know of no optometrists who do not feel the injustice of our present position in the armed forces. Not only are men everywhere keenly aware of the harm being done, but on every side optometrists are demanding that action be taken now before it is too late.

CAREL C. KOCH

OPTOMETRY, TOO, MUST FIGHT INFLATION

A nation wide "trend-of-thought" survey was recently conducted by a national organization.[1] This survey was instituted to determine just what citizens in various parts of this country were thinking on a number of timely subjects. Such matters as the conduct of the war, rationing, post-war plans and agriculture were considered. Inflation, too, was touched upon, and most serious in its general import was the disclosure that there is little or no real concern about the danger of inflation. Sixty-five per cent of those interviewed seemed not to realize, or did not care, or were not interested about inflation. Twenty-three per cent of the business and professional men reported that they were somewhat worried about inflation but the great majority indicated they were most interested in getting more money and were willing to pay almost any price for the things they wanted to get.

The survey further disclosed that among persons interviewed on the street that most did not realize what inflation could do to the country, but felt that "it could not happen here."

The conditions revealed by this study are too serious to optometry to be passed over slightly. All optometrists must be made to understand that price raises and inflation are one and the same thing. They must realize,

[1]American Legion. September, 1943.

too, that fees can not keep up with costs of living when inflation once starts. That the cost of the war would be so increased that it would be impossible to raise funds and that we can easily ruin the country our young men are fighting for, if inflation gets a big head start. It still can be controlled, if all citizens *insist that it be controlled.*

The fight against inflation is everyone's fight. It must not be left to the other fellow. Optometrists are not immune to the dangers of inflation and as a professional group should be alert to protect, not only their own assets, but their country as well from the ravages of this fatal economic malady.

CAREL C. KOCH

TRANSACTIONS OF THE AMERICAN ACADEMY OF OPTOMETRY

by J. Fred Andreae, Secretary

A department devoted to announcements, reports, appointments, organization data, news, professional problems and ideals, as these relate to the Academy.

POST-WAR OPTOMETRY

"Our chiefest care must still be directed to the Army and Navy, who have thus far borne their harder part so nobly and well; and it may be esteemed fortunate that in giving the greatest efficiency to these indispensable Arms we do also honorably recognize the gallant men, from commander to sentinel, who compose them and to whom more than others the world must stand indebted for the home of freedom disenthralled, regenerated, enlarged, and perpetuated"—

Abraham Lincoln, December 8, 1863.

It is exactly eighty years since these words were spoken and yet we find ourselves again in the same position. We say, the last three years have been the most eventful in the history of our country, but this seems true only because this war is closer to us and in turn effects us more. However, it is at this season of the year, we value more highly those things for which our soldiers are fighting, freedom from tyranny and for the American way of life. Some day and, I believe in the not too distant future, peace will rule the earth and our fellow Optometrists will return home to establish themselves in their communities. Those Optometrists

in the armed forces are serving their country nobly and well and many are serving without the recognition to which their profession should entitle them.

Let us not forget, those of us who have remained at home during this conflict, to plan now for post-war Optometry. I sincerely believe Optometry is at the crossroads, one road leading toward eventual oblivion and the other toward recognition of the great service our profession is capable of rendering.

How may we travel the right road? By establishing ourselves in a position above reproach by other professions and by the public.

At this Holiday Season, I call on every Academy Member to take stock of himself, and to work toward an objective which will make our Optometrists, when they return from battle, proud to say, "I am an Optometrist."

ARTHUR P. WHEELOCK.

TRANSPARENCIES OF THE HUMAN EYE

The Academy wishes to call particular attention to the work of McHugh, Kronfeld and Polyak who have recently presented to all ocular workers their atlas, "The Human Eye in Anatomical Transparencies."

The plan underlying this new book is essentially topographic. The authors approach the orbit and the eye itself from the front and from the temporal side. Where there was natural stratification, the structures are illustrated layer by layer. In the absence of such stratification the tissues are illustrated. Macroscopic structures visible on the back as well as on the front surfaces of the natural strata are depicted by McHugh on successive transparent pages. These pages have then been superimposed, one upon the next, presenting a remarkable synthesis of the anatomical structures of the eye. These many colored transparencies, when used together, afford a three dimensional atlas that is both interesting and of great value.

The entire work was produced by a new "trans-vision" process in which the multi-color printing was laid directly upon transparent sheets, which were then carefully gathered and bound so that the edges of all illustrations matched. The finished product is a decided advancement over previous works in this field.

The book is published by Bausch & Lomb. It may be ordered through any optical laboratory. The cost is $6.50. All optometrists should own this great war time contribution to our science.

CAREL C. KOCH.

SPECIAL REPORTS

MEMORIAL AWARD TO FURTHER OPTOMETRIC RESEARCH

Pennsylvania State College of Optometry

A great loss befell the graduating class of Pennsylvania State College of Optometry when one of their classmates, Samuel Levitt, Lieutenant in the United States Army Air Forces, gave his life while on active duty. He was the first casualty in World War II among former students.

In deep sympathy and thoughtful memory, members of this Class planned and raised sufficient funds for the purpose of instituting the Samuel Levitt Memorial Award, presented to that member of each graduating class who will have submitted the most outstanding thesis on a subject for original research in optometry. Preference will be given to those papers based on original clinical or experimental work. The Faculty of the Pennsylvania State College of Optometry will be the sole and absolute judge in selecting recipients of the award.

Samuel Levitt met his untimely end in August, 1943, in an airplane crash while in flight at his station. He was 24 years old, a native of Philadelphia. With this Award, though he can never serve optometry in a professional capacity, he makes a great contribution to the advancement of the optometric profession as a whole, through the regard of those who valued his fellowship and patriotism.

BOOK NOTICES AND REVIEWS

Books received are acknowledged by notices in this department. Special selections will be made for more extensive review in the interest of our readers as space permits.

RECONSTRUCTIVE SURGERY OF THE EYELIDS. Wendell L. Hughes, M.D., F.A.C.S. Published by the C. V. Mosby Company, St. Louis, Mo. 198 illustrations. 160 pages. Cloth. $4. 1943.

The subject matter of this book was presented as a thesis for admission to the American Ophthalmological Society and represents the evolvement of methods for the reconstruction of new lids along with a historical review of previous methods. In a period of war the subject is uppermost

in the minds of many surgeons. The text is well illustrated and should prove to be a useful surgical handbook. A. V. F.

CLINICAL AUDIOMETRY. C. C. Bunch, M.A., Ph.D. Published by the C. V. Mosby Company, St. Louis, Mo. 74 illustrations. 186 pages. Cloth. $4. 1943.

This well illustrated text deals with deafness and the more modern tests used to determine the type and extent of subnormal hearing. A considerable portion of the book is given over to a detailed review of the technique of using an audiometer. A. V. F.

ABSTRACTS

A department in which will appear abstracts of the literature of optometry, ophthalmology and applied optics. These will be classified according to the following list, although contributions to all sections will not necessarily appear in each issue.

1. Ocular Refraction.
2. Physiological Optics and Color Vision.
3. Ocular Muscles.
4. Orthoptics and Reading.
5. Anatomy, Histology and Embryology.
6. Ocular and General Pathology.
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8. Instruments.
9. Hygiene and Illumination.
10. Applied and Physical Optics.
11. Education, Sociology and Economics.
12. Miscellaneous.

6. OCULAR AND GENERAL PATHOLOGY

OCULAR SYMPTOMS DUE TO VITAMIN DEFICIENCIES. A. Sayer, Columbia Optometrist, 1943, 17, 65, 2.

Sayer presents the symptoms sometimes present in patients whose diets have been deficient in one or more of the vitamins. He adds, "From the therapeutic standpoint correction of the inadequacies of the diet is of the utmost importance, for the relief of the various eye symptoms due to avitaminosis. Pharmaceutical vitamin preparations are to be prescribed concurrently with the proper diet. A well balanced diet containing an abundance of fresh fruits and vegetables, whole grain cereals, meats, eggs and milk will adequately supply the body with an abundance of the various vitamins necessary for health. One should, however, remember that a diet usually suitable for a healthy person, may not be adequate for a person already suffering from avitaminosis. This is especially true if the vitamin deficiency is severe or of long duration. Vitamin supplements should therefore be prescribed in much larger amounts than the usual normal requirements." G. L. DuP.

A CASE OF BINOCULAR CONGENITAL PTOSIS. D. Volk, Optical Journal and Review of Optometry, 1942, 79, 1, 24-25.

The author reviews a case of binocular congenital ptosis of the lids and outlines his procedure in making and fitting the proper ptosis crutches and attaching these to the spectacle frame. C. C. K.

HIGH (OCULAR) TENSION. H. G. Noyes, Columbia Optometrist, 1943, 17, 66, 3.

In the optometric detection of glaucoma, (1) Suspect: All over 40, especially women, people with small hyperopic eyes, Negroes, and those who need glasses changed every six months or less.

(2) Inspect: The episclera may have a faint blush, cornea may be slightly cloudy, anterior chamber shallow, iris dull, pupil somewhat enlarged, oval, and sluggish in reacting to light. The hand slit-lamp will help at this point.

(3) Detect: The alternate pressing of fingertips on the upper lid while the patient looks down, gives a rough idea of the intraocular pressure, especially when compared with that of the examiner. Field-taking is most important, but need not take hours if some very simple apparatus is used. The very least that should be done (on *every* patient) is the confrontation test, comparing examiner's field by moving a finger at the periphery while having examinee fix one eye, then the other, while the opposite eye is covered by the palm.

(4) Correct: Both of the two most probable causes for increased tension, overgrowth of the ciliary body and swelling of the lens, are somewhat alleviated by proper refractive correction. All possible strain should be removed from accommodation. Convergence, also, should be erased by prisms, base in. This also helps take some load off focusing. Recheck on glasses should be made at least *yearly*.

Habits of reading should be regulated. Lighting must be bright. Movies are allowed but seldom (no double features). Other health measures would best be left to the family physician or consulting ophthalmologist.

Many cases could be cited where the optometrist has been the one to recognize a beginning glaucoma. Many more will be found early if these rules for examining are kept in mind. G. L. DuP.

LIGHT SENSE IN PIGMENTARY DEGENERATION OF THE RETINA. L. L. Sloan, Archives of Ophthalmology, 1942, 28, 4, 613.

The author presents studies which show that defects in scotopic vision occur early in the course of development of pigmentary degeneration of the retina. The defects may consist in a more or less equal increase in the light thresholds throughout the entire visual field. In the majority of cases, however, the threshold gradient curve of the dark-adapted eye shows greater defects in the midperipheral zones than in the far periphery and may show no significant increase in threshold in the central field until the defects in other regions are well advanced. The relatively early involvement of the midperiphery is in accord with the results of ordinary perimetric studies.

The characteristic defects both in the visual fields and in the threshold gradient curve are essentially similar in patients with and without the typical pigmentary deposits in the retina. When pigmentary deposits are present, the location of the most extensive ones corresponds as a rule to the region where the subjective tests show the greatest loss of function.

Detection of the incipient stages of functional loss in pigmentary degeneration of the retina by means of tests of scotopic vision may be of importance in determining the fitness of persons for certain occupations which must be carried on in dim illuminations. Such tests may also be of use in the critical evaluation of possible therapeutic measures. Because they are an aid to early diagnosis, they make it possible to test the effect of treatment in the incipient stages of the disease. Quantitative tests of scotopic vision are also of value in determining whether or not there is improvement in visual function as a result of the treatment.

T.O. B.

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This is an index covering all of the departments of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY. The letters used to explain in which department the material indexed appears are as follows: (OP), Original paper; (CC), Current Comments by Carel C. Koch; (E), Editorial; (T), Transactions of the Academy by J. Fred Andreae; (PI), Procedure and Instrumentation by G. L. DuPlessis; (OJ), Organization and Jurisprudence by Clarence W. Morris; (SR), Special Reports; (C), Correspondence; (Ab), Abstracts; (I), Inquiry and Explanatory Notes; (BN), Book Notices; and (A), Announcements.

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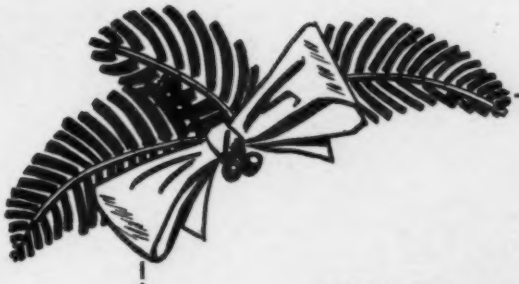

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